Zander (*Sander lucioperca*)
Ecological Risk Screening Summary

Web Version, 9/18/2012

Photo: FishBase

1 Native Range, and Status in the United States

Native Range
From Fuller (2011):

"Continental Europe to western Siberia (Berg 1949; Robins et al. 1991)."

Nonindigenous Occurrences

From Fuller (2011):

"This species was reportedly stocked in ponds near Cooperstown, New York, in the late 1970s by an individual from Germany (J. Nickum, personal communication). Hatchery-reared zander fingerlings were stocked into Spiritwood Lake (Stutzman County), North Dakota in 1989 (Lohman 1989; Anderson 1992; Dokken 2004). An individual was caught in August 1999 and another one, a 2+ year old individual, was captured from Spiritwood Lake in June 2000."

Means of Introductions

From Fuller (2011):

"Stocked for sport fishing."

Remarks

From Fuller (2011):

"Although it was thought that zander stocked into a North Dakota lake did not survive (e.g., Anderson 1992), the capture of a fish in August 1999, and another 2+ year old fish in 2000 shows that at least some survived and reproduced. Five young-of-the-year fish were collected in 2005. As of 2009, the state reports that they are established in Spiritwood Lake. The North Dakota Game and Fish Department reports capture of yearlings and 2-year olds, although they [say] the population is very small. Genetic sampling of fish has found that all are pure zander, there has been no hybridization. Spiritwood Lake is normally a closed basin, however it did flood several years ago (1998-2001). The Department sampled and did not find any evidence that zander escaped the lake during the flood (L. Schlueter, personal communication). Reported from New York (Courtenay et al. 1986)."

"Courtenay et al. (1986) listed this species from New York, but the record was based on an unconfirmed report. The history of its introduction into North Dakota is not well documented in the scientific literature. Apparently the North Dakota Game and Fish Department had been interested in zander as a sport fish for many years and that agency chose Spiritwood Lake as the site of an experimental release because the water body was completely enclosed (Anderson 1992). In 1987, prior to the lake introduction, the state had hatched eggs imported from Holland, but the resulting fry were destroyed for fear that they carried pike fry rhobdo virus (Anonymous 1987a; Lohman 1989). Those wanting to introduce zander thought that it would be a boon to the fisheries of North America (e.g., Anderson 1992), whereas others expressed strong reservations (e.g., Wright 1992). Some fisheries personnel in states surrounding North Dakota and nearby Canadian provinces expressed doubts concerning the species' introduction, particularly because its effect on native species was unknown and because of its potential to spread (e.g., Wingate 1992). The zander has been widely introduced into western Europe and the species was illegally introduced into portions of England. According to Hickley (1986), the success of introduced populations seemed to be limited by the availability of the species' preferred habitat, characterized as "eutrophic, turbid, well oxygenated and of low mean depth, and, if a river, slow-flowing rather than turbulent." Zander feed heavily on prey of small size. Because of this, there

is concern among European fish resource managers that introduced zander may cause a collapse in resident prey fish stocks (Hickley 1986 and references therein)."

"Spiritwood Lake has been connected to the James River for three years (1998-2001) because of high water conditions. There is concern that zander may have escaped into the James River. Sampling efforts have found no evidence of that (L. Schlueter, personal communication)."

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

From ITIS (2012):

"Kingdom Animalia
Phylum Chordata
Subphylum Vertebrata
Superclass Osteichthyes
Class Actinopterygii
Subclass Neopterygii
Infraclass Teleostei
Superorder Acanthopterygii
Order Perciformes
Suborder Percoidei
Family Percidae
Genus Sander
Species Sander lucioperca (Linnaeus, 1758)"

Taxonomic Status: "Valid"

Size, Weight, Age

From Froese and Pauly (2010):

"Max length : 100.0 cm SL male/unsexed; (Kottelat and Freyhof 2007); common length : 50.0 cm TL male/unsexed; (Muus and Dahlström 1968); max. published weight: 20.0 kg (Keith and Allardi 2001); max. reported age: 17 years (Kottelat and Freyhof 2007)."

Environment

From Froese and Pauly (2010):

"Pelagic; potamodromous (Riede 2004); freshwater; brackish; depth range 2 - 30 m (Billard 1997), usually 2 - 3 m (Gerstmeier and Romig 1998)"

Climate/Range

From Froese and Pauly (2010):

"Temperate; 6°C - 22°C (Baensch and Riehl 1991); 67°N - 36°N, 1°W - 75°E."

Distribution

From Froese and Pauly (2010):

"Europe: Caspian, Baltic, Black and Aral Sea basins; Elbe (North Sea basin) and Maritza (Aegean basin) drainages. North to about 65° N in Finland. Introduced widely (Kottelat and Freyhof 2007). Several countries report adverse ecological impact after introduction (Welcomme 1988)."

Means of Introduction Outside the United States

From Larson and Berg (2011):

"S. lucioperca has been introduced for both commercial and recreational fishing – the fish is very tasty and has high market and angling value. Furthermore, the species has been used for biomanipulation in order to reduce the number of unwanted fish, usually cyprinids (Lappalainen et al. 2003)."

Short description

From Larsen and Berg (2011):

"*S. lucioperca* has a long slender body. There are no spines on the gill cover. The mouth has many small teeth and fewer large teeth for catching the prey. The species has two dorsal fins – one with 13 to 20 spines and one with 1-2 spines and 18 to 24 soft rays. The caudal fin has 17 soft rays and the anal fin has 2-3 spines and 10-14 soft rays (see Fig. 2)."

"S. lucioperca obtains a maximum length of 100-130 cm which corresponds to a weight of about 15-20 kg. Maximum age is inversely correlated to growth rate. Slow-growing *S. lucioperca* in the northern part of the distribution area reach 20-24 years of age, while faster-growing *S. lucioperca* in the southern part only reach about 8-9 years (Sonesten 1991)."

Biology

From Froese and Pauly (2010):

"Inhabits large, turbid rivers and eutrophic lakes, brackish coastal lakes and estuaries. Feeds mainly on gregarious, pelagic fishes. Attains first sexual maturity at 3-10 years of age, usually at 4. Undertakes short spawning migrations. Individuals foraging in brackish water move to freshwater habitats. Migrations up to 250 km have been recorded. Homing is well developed, even nearby populations may be relatively isolated. Spawns in pairs at dawn or night. Spawning occurs in April-May, exceptional from late February until July, depending on latitude and altitude when temperatures reach 10-14° C on spawning grounds (Kottelat and Freyhof 2007). Popularly fished by sport fishers. Its flesh is succulent (Billard 1997). Utilized fresh or frozen and eaten steamed, broiled and microwaved (Frimodt 1995). An individual weighing 19 kg was reportedly caught in 1959 in Starnberger, Bavaria, Germany (Peter Admicka, pers. comm.…). The Lake Hjälmaren Pikeperch Fish-Trap fishery of this species has been certified by the Marine Stewardship Council (http://www.msc.org/) as well-managed and sustainable (http://www.msc.org/html/content_1280.htm)."

Human uses

From Froese and Pauly (2010):

"Fisheries: commercial; aquaculture: commercial; gamefish: yes; aquarium: public aquariums."

Diseases

None reported.

Threat to humans

From Froese and Pauly (2010):

"Potential pest."

3 Impacts of Introductions

From Fuller (2011):

"Unknown. Concern exists that zander and walleye could hybridize. So far there has been no evidence of that happening (L. Schlueter, personal communication). There has been no discernible impact on native walleye or perch populations (L. Schlueter, personal communication)."

From Larsen and Berg (2011):

"**Affected habitats and indigenous organisms**
S. lucioperca is piscivorous and normally feed on cyprinids, smelt (*Osmerus eperlanus*), ruffe/pope (*Acerina cernua*) etc. In the springtime *S. lucioperca* also predate on smolts of sea-trout (*Salmo trutta*) and salmon (*Salmo salar*) when they migrate to the sea. Studies from River Gudenaa, Denmark has shown that predation on smolts in the lower part of the river has an adverse effect on the population of sea-trout (Jepsen et al. 2000, Koed 2001, Koed et al. 2002)."

"Other adverse effects on natural fish populations, as a result of introduction of *S. lucioperca*, have been described. Schulze *et al.* (2006) found that the perch (*Perca fluviatilis*) population in a shallow, mesotrophic lake with natural occurrence of perch and pike (*Esox lucius*) were negatively affected by *S. lucioperca* introduction. In an experiment they showed that perch was forced away from its preferred habitat, the pelagic zone, by *S. lucioperca*. As the littoral zone was already occupied by pike, the perch population was "sandwiched" between pike and the introduced *S. lucioperca*. As perch has been found to be the most important predator to control the density of zooplanktivorous 0+ cyprinids in Danish lakes, the introduction of *S. lucioperca* must be considered as negative and indeed has been observed to result in reduced environmental conditions compared to the expected in eutrophic Danish lakes (Jerl Jensen, pers. comm.)."

"Several authors have reported reduced population densities of cyprinids as a result of *S. lucioperca* introduction. Jeppesen *et al.* (2001) found evidence of this in a paleolimnologic study in the Danish Lake Skanderborg, where *S. lucioperca* was introduced in 1903-04. After this a permanent reduction in cyprinid densities was found. Based on theoretical modeling Nilsson (2001) also predicted reduced density of prey fish (roach (*Rutilus rutilus*) in the model) when *S. lucioperca* is introduced to lake ecosystems with pike already present. Cowx (1997)) found that introducing *S. lucioperca* to English rivers created a crash in the cyprinid fish community."

"Brabrand and Faafeng (1993) showed how young roach shifted from pelagic to littoral habitats as a result of *S. lucioperca* introduction in a Norwegian lake. An indirect effect of the changed behaviour of roach was increased infection rate of roach with the ectoparasite *Ichthyophthirius multifiliis*, as roach was more often exposed to the free swimming state of *Ichthyophthirius multifiliis* when living in shallow water near the substrate compared to their previously more pelagic lifestyle (Brabrand *et al.* 1994)."

"In the Turkish Lake Egredir *S. lucioperca* was introduced in 1955 and from 1961 it became an important species in commercial fisheries in the lake. The introduction also had the result that 5 out of 9 indigenous fish species disappeared, among these three species of *Phoxinellus*, two of which were endemic to Lake Egredir (Crivelli 1995)). Consequently these two species must now be considered extinct worldwide."

From Larsen and Berg (2011):

"**Genetic effects**
In Finland there is a growing concern about the potential loss of genetic diversity of the native *S. lucioperca* populations due to enhancement stocking with foreign *S. lucioperca*."

From Larsen and Berg (2011):

"**Human health effects**
High concentrations of toxic compounds from algae-preventing (anti-fouling) paints have been reported in some of the Finnish coastal *S. lucioperca* populations."

From Larsen and Berg (2011):

"**Economic and societal effects (positive/negative)**
S. lucioperca is a valuable fish – it has a high market value and is a target species in angling. After its introduction to Danish lakes, it soon became an economically very important species in commercial fisheries. At present the value of commercial inland fisheries in Denmark is very low while the value and social importance of recreational fisheries (both local angling and angling tourism) is increasing (Jacobsen *et al.* 2004). In the Turkish Lake Egredir, the value of commercial fisheries increased several fold after the introduction of *S. lucioperca*, both because all the indigenous fish species had a very low commercial value compared to *S. lucioperca* and due to a drastic increase in the population of *Astacus leptodactylus*. In 1981 fisheries yield were 310 tonnes of *S. lucioperca* and 1573 tonnes of *A. leptodactylus* (Crivelli 1995). Before 1965 the commercial catch of *A. leptodactylus* was zero. In Latvia, where the species is native, a commercially important coastal fishery takes place. The annual catch is 30 - 80 tons, mostly in the southern part of the Gulf of Riga. The species is also a quite common catch for anglers in some freshwater bodies, mainly in the areas where it is regularly restocked (Nature in Latvia)."

"Even though studies in Denmark have shown that the predation from *S. lucioperca* can have an adverse effect on populations of anadromous salmonids and lake ecosystems, *S. lucioperca* is still protected by the Danish Fishery Act by both a closed season and minimum size limit, due to its importance to commercial and recreational fisheries."

From Anseeuw et al. (2011):

"The introduction of this predatory fish in Western Europe created a crash in some cyprinid fish communities. Populations of native piscivorous fish species (*Esox lucius, Perca fluviatilis*) were locally depleted due to interspecific competition. The pike-perch is also a vector of the *Bucephalus polymorphus* parasite, that can affect native cyprinid fish species; however, a massive outbreak of this parasite has never been reported from Belgium."

From Innal and Erk'akan (2006):

The authors report that *S. luciopeca* was introduced in Egirdir and Marmara Lakes, Apa and Ayranci reservoirs Çubuk 2 Dam Lake, Demirköprü Dam Lake, Mamasin Dam Lake, Sarimsakli Dam Lake, Hirfanli Dam Lake, Damsa Dam Lake, Seyhan Dam Lake, Lake Gölcük and Selevir Dam Lake. The authors go on to say: "After introduction of Zander to Beysehir Lake, the number of fish species have been decreasing drastically [and three species were suspected to have gone extinct]. The three species presumed extinct were endemic to Turkey."

From Welcomme (1988):

"[Introduced through] diffusion along Rhine River system. Very successful and still spreading but may be responsible for the decline of *Esox lucius*."

"Reintroduced in 1910. Established in many southern rivers particularly in Great Ouse and continues to spread either naturally or by introductions. Highly appreciated by anglers but not by conservationists. Evidence of decline in native *Esox lucius* and *Perca fluviatilis* (Linfield and Rickards (1979). "

4 Global Distribution

Figure 1 (above). Global distribution of *S. lucioperca*. Map from GBIF (2010).

5 Distribution within the United States

Figure 2 (above). Distribution of *S. lucioperca* in the United States. Map from Fuller (2011).

6 CLIMATCH

Summary of Climate Matching Analysis

The climate match (Australian Bureau of Rural Sciences 2010, 16 climate variables; Euclidean Distance) was high across the northern tier of the country and the west and high plains. Medium matches extended deep into the South. Low matches in South Florida, the Gulf Coast, and Desert Southwest. Climate 6 match indicated that the United States has a high climate match. The range for a high climate match is 0.103 and greater, climate match of *S. lucioperca* 0.451.

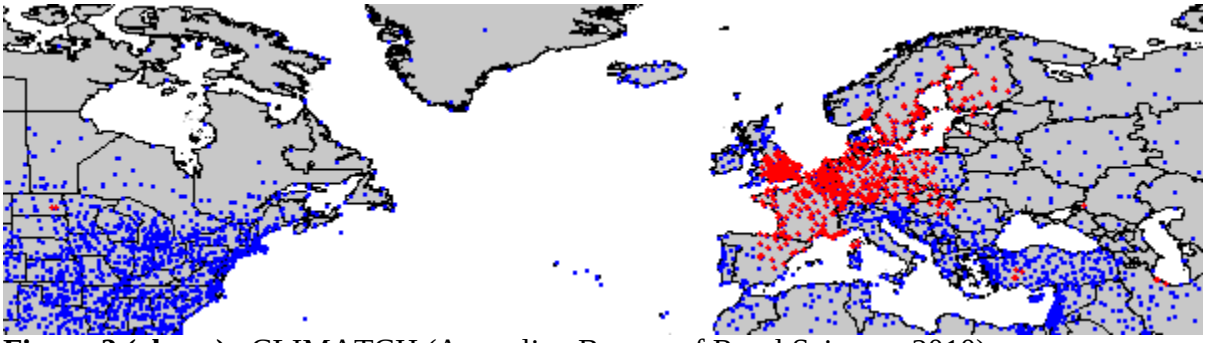

Figure 3 (above). CLIMATCH (Australian Bureau of Rural Sciences 2010) source map showing weather stations selected as source locations (red) and non-source locations (blue) for *S. lucioperca* climate matching. Source locations from GBIF (2010) and Fuller (2011).

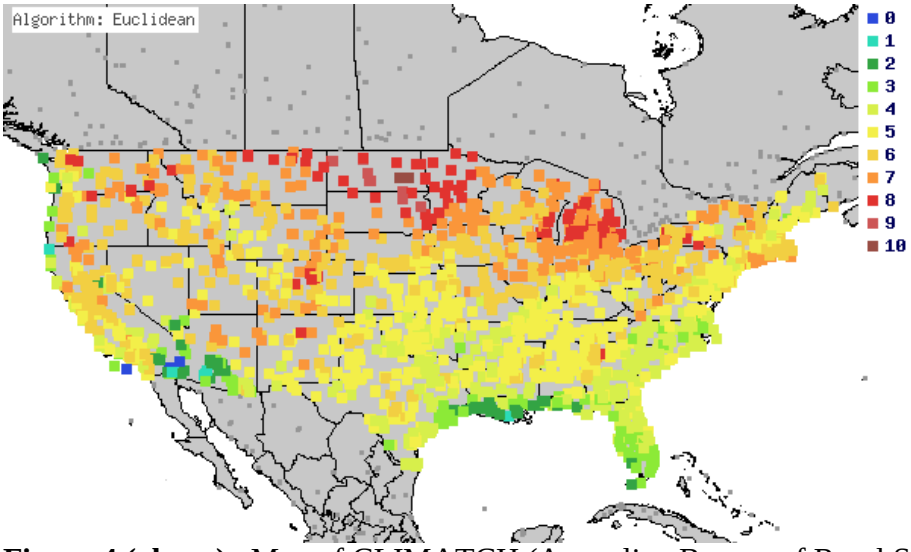

Figure 4 (above). Map of CLIMATCH (Australian Bureau of Rural Sciences 2010) climate matches for *S. lucioperca* in the continental United States based on source locations reported by GBIF (2010) and Fuller (2011). 0= Lowest match, 10=Highest match.

Table 1 (below). CLIMATCH (Australian Bureau of Rural Sciences 2010) climate match scores

CLIMATCH Score	0	1	2	3	4	5	6	7	8	9	10
Count	4	8	57	110	318	586	489	294	96	10	2
Climate 6 Proportion =			0.451	(High)							

7 Certainty of Assessment

Information on the biology and impacts of this species is readily available. Certainty of assessment for this species is high.

8 Risk Assessment

Summary of Risk to the Continental United States

S. lucioperca has been introduced to the United States many times, but has only one established population in Spirit Lake, North Dakota. In Europe, *S. lucioperca*, has established itself in many introduced areas. Impacts from these introductions include reduced populations of prey fish and competitor fish, as well as trophic changes, and in the case of some Turkish lakes, extirpation of endemic species. The high climate match of this species in the Great Lakes indicates the potential risk of introduction.

Assessment Elements

- **History of Invasiveness (See Section 3):** High
- **Climate Match (See Section 6):** High
- **Certainty of Assessment (See Section 7):** High
- **Overall Risk Assessment Category: High**

Sec. 9 – References

Note: References cited within quoted text but not accessed for this ERSS are included in Section 10 below.

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